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Project Report COE-03-2

Evaluation of the Indoor Air Quality and Ventilation System of the Waterfield Building 803 Front Street, Norfolk, Virginia

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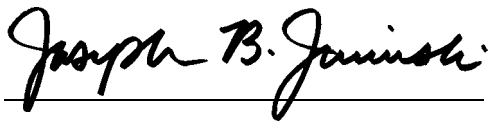
Submitted by: 

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1.0 INTRODUCTION

The U.S. Army Corps of Engineers (COE) requested that NuChemCo, Inc. (NCC) conduct an indoor environmental quality (IEQ) and a heating, ventilation, and air conditioning (HVAC) survey of the Waterfield Building located at 803 Front Street in Norfolk, Virginia. Joseph B. Jurinski, Ph.D., CIH, P.G., NCC Industrial Hygienist, performed the IAQ survey. The Heating, Ventilation, and Air Conditioning (HVAC) survey was performed by Kenneth R. McLauchlan, P.E., Ventilation Engineer.

The IAQ survey was conducted to re-evaluate conditions relative to an investigation conducted by NCC at the Waterfield building in 1992. The survey was also performed to document conditions in response to employee concerns of visual findings of mold in some of the areas of the building. It was reported that there were past findings of visible mold growth in training rooms located on the first floor of the building. The moisture source was reportedly related to condensation of moisture during high humidity periods onto cold building surfaces. It was reported that the moisture issues had been addressed and that the visible growth had been cleaned. Some impacted upholstered furniture was reportedly replaced.

NCC collected air samples to test for the presence of the following airborne chemical contaminants: formaldehyde, carbon dioxide and a number of other common indoor air pollutants. Samples were also collected for airborne fungal spores. In addition, temperature and relative humidity readings were taken. Also, a Mechanical Engineer conducted an evaluation of the ventilation system serving the building.

The offices are primarily located on floors 2 through 4 of the building. Most of the office space consisted of cubicle work areas divided by modular partitions that were approximately 6 feet tall. Occasionally, individual offices and other areas isolated by floor to ceiling partitions were located on the perimeter of the floors.

The first floor contained several offices, a cafeteria, training rooms and storage areas.

The assistance of the Safety Office and facilities personnel is gratefully acknowledged.

2.0 SAMPLING AND ANALYSIS

NCC recognizes that not every sampling location was selected for purposes of this study, and NCC does not suggest that every available location within the office building was included in the study zone.

2.1 Laboratory-analyzed samples

2.1.1 Formaldehyde

NCC conducted air sampling for formaldehyde using constant flow rate battery operated pumps to draw air through collection media. Formaldehyde samples were collected at a flow rate of approximately 0.4 liters per minute. Formaldehyde vapors have been frequently reported as emissions from new carpet installations and may also be associated with emissions from particleboard and other processed wood products and other new finish materials. Formaldehyde vapor samples were collected onto a phenylhydrazine treated silica gel absorption tube. All collection tubes had a front and rear collection bed to check for vapor breakthrough problems during sampling. A field blank sample was prepared to verify the acceptability of the collection media used. After sampling, each sample tube was labeled with a unique sample identification number and later submitted for chemical analysis to Quest Diagnostics/American Medical Laboratories, Inc. Industrial Hygiene Division (AML). This laboratory is accredited by the American Industrial Hygiene Association (AIHA) and successfully participates in the AIHA Proficiency Analytical Testing Program.

2.1.2 Total Hydrocarbons

NCC conducted air sampling for total hydrocarbons using constant flow rate battery operated pumps to draw air through collection media. Total hydrocarbon air samples were collected at a flow rate of 1 liter per minute. Hydrocarbons are compounds that may be released from construction materials such as paints, or also from many other common sources. Hydrocarbon vapor samples were collected onto an activated charcoal tube. All collection tubes had a front and rear collection bed to check for vapor breakthrough problems during sampling. A field blank sample was prepared to verify the acceptability of the collection media used. After sampling, each sample tube was labeled with a unique sample identification number and later submitted for chemical analysis to AML.

2.1.3 Fungal Spores

NCC collected air samples to measure airborne fungal spore concentrations. The air samples were collected at a flow rate of 10 liters per minute for a 9-minute period using a Burkard Volumetric Air Sampling pump. The samples were collected onto microscope slides prepared by the laboratory. Each sample was labeled with a unique

identification number. Control samples were collected, including outside air samples and a field blank. The samples were submitted to Aerobiology Laboratory Associates (Aerobiology), located in Reston, Virginia. This laboratory is accredited by AIHA under their environmental microbiology accreditation program. The samples were analyzed using microscopy techniques to evaluate the concentrations and types of fungal spores in the samples.

2.2 Direct reading measurements

Measurements were made to evaluate ventilation system performance and to evaluate the office areas for typical indoor environmental quality parameters. NCC measured the temperature and humidity by use of a sling psychrometer. Carbon dioxide concentrations were measured in the office using a Telaire 7001 carbon dioxide meter. Carbon monoxide was measured with a Gastec Safe-T-Mate. Airborne dusts were measured using a MIE personal real time aerosol monitor.

3.0 SAMPLE RESULTS

Table 1: Formaldehyde Results

Sample #	Location	Air Volume (l)	Result (ppm)
030129-1JJ	4th floor, SE quadrant, outside B. Arthur's cube	158	0.0058
030129-2JJ	3rd floor, NE quadrant, supply/printer cubicle	154	0.0046
030129-3JJ	2nd floor, NW quadrant, hallway outside computer room entrance	152	0.0061
030129-4JJ	1st floor, SW quadrant, table in Emergency Management office	152	0.0057
030129-5JJ	Field Blank	0	< 0.18 µg

ppm – parts per million

Table 2: Total Hydrocarbon Results

Sample #	Location	Air Volume (l)	Result (mg/M^3)
030129-6JJ	4th floor, NW quad., copier/printer cube	156	0.19
030129-7JJ	4th floor, SW quad., M. Camsky's cube	157	0.083
030129-8JJ	4th floor, NE quad., K. Jenkins' cube	155	0.077
030129-9JJ	4th floor, SE quad., adj. B Arthurs's cube	156	0.37
030129-10JJ	3rd floor, NE quad., supply/printer cabinet	156	0.10
030129-11JJ	3rd floor, NW quad., outside M. Byrne's cube	159	0.075
030129-12JJ	3rd floor, SE quad., O. Hart's cube	173	0.075
030129-13JJ	3rd floor, SW quad., outside R. Underwood's cube	165	0.11
030129-14JJ	2nd floor, SE quad., plotter area	167	1.4
030129-15JJ	2nd floor, NE quad., outside D. Nixon's cube	163	0.20
030129-16JJ	2nd floor, NW quad., outside computer room	156	0.071
030129-17JJ	2nd floor, SW quad. outside H. Jones' cube	154	0.16

Table 2: Total Hydrocarbon Results (continued)

Sample #	Location	Air Volume (l)	Result (mg/M^3)
030129-18JJ	1st floor Emergency Management office	95	0.096
030129-19JJ	1st floor, Training Room A	94	0.13
030129-20JJ	1st floor, NE quadrant, warehouse	93	2.0
030129-21JJ	1st floor, NW quadrant, warehouse	93	0.059
030129-22JJ	Field Blank	0	<1.6 µg

mg/M^3 - Milligrams per cubic meter

Table 3: Total Fungal Spore Sample Data

Sample #	Location	Total Spore Count ($spore/M^3$)	Spore Identifications ($spore/M^3$)
030129-23JJ	Outside Air, roof	88	Cladosporium – 11 Smuts, etc. – 11 Colorless – 11 Hyphal elements – 11 Torula herbarium – 11 Algae - 33
030129-24JJ	4th floor, SE quad., adj. B Arthurs's cube	11	Basidiospores – 11
030129-25JJ	4th floor, NE quad., K. Jenkins' cube	11	Colorless – 11
030129-26JJ	4th floor, NW quad., copier/printer cube	22	Cladosporium – 22
030129-27JJ	4th floor, SW quad., M. Camsky's cube	11	Hyphal elements – 11
030129-28JJ	3rd floor, SE quad., O. Hart's cube	< 11	none seen
030129-29JJ	3rd floor, NE quad., supply/printer cabinet	< 11	none seen
030129-30JJ	3rd floor, NW quad., outside M. Byrne's cube	11	Smuts, etc. – 11
030129-31JJ	3rd floor, SW quad., outside R. Underwood's cube	33	Smuts, etc. – 11 Drechslera/Bipolaris – 22

Table 3: Total Fungal Spore Sample Data (continued)

Sample #	Location	Total Spore Count (spore/M^3)	Spore Identifications (spore/M^3)
030129-32JJ	2nd floor, SE quad., plotter area	22	Cladosporium – 11 Hyphal elements – 11
030129-33JJ	2nd floor, NE quad., outside D. Nixon's cube	55	Stachybotrys – 44 Hyphal elements – 11
030129-34JJ	2nd floor, NW quad., outside computer room	11	Ascospores – 11
030129-35JJ	2nd floor, SW quad. outside H. Jones' cube	< 11	none seen
030129-36JJ	1st floor NE quad., warehouse	33[A]	Smuts, etc. – 11 Unknown – 11 Hyphal elements - 11
030129-37JJ	1st floor, SE quad., warehouse	66	Basidiospores – 22 Penicillium/Aspergillus – 11 Algae – 33
030129-38JJ	1st floor, Emergency Preparedness office	22	Hyphal elements – 22
030129-39JJ	1st floor, Training Room A	< 11	none seen
030129-40JJ	Outside Air, ground level	132	Cladosporium – 22 Smuts, etc. – 44 Penicillium/Aspergillus – 33 Hyphal elements – 22 Torula herbarium - 11
030129-41JJ	Field Blank	None Seen	None Seen

spore/M^3 = spores per cubic meter of air

[A]count may have been underestimated due to particulate loading

Table 4: Direct Reading Instrument Results

Location	Temp (°F)	Relative Humidity (%)	CO_2 (ppm)	CO (ppm)	Dust (mg/M^3)
Outside Air, roof	48.5	40	351	< 1	0.021
4th floor, SE quad., adj. B Arthurs's cube	74	19	461	< 1	0.007
4th floor, NE quad., K. Jenkins' cube	73.5	20	472	< 1	0.005
4th floor, NW quad., copier/printer cube	74	20	504	< 1	0.003
4th floor, SW quad., M. Camsky's cube	73.5	20	476	< 1	0.007
3rd floor, SE quad., O. Hart's cube	74.5	20	463	< 1	0.005
3rd floor, NE quad., supply/printer cabinet	74	22	497	< 1	0.007
3rd floor, NW quad., outside M. Byrne's cube	75	20	526	< 1	0.004
3rd floor, SW quad., outside R. Underwood's cube	75	20	514	< 1	0.007
2nd floor, SE quad., plotter area	75	20	586	< 1	0.009
2nd floor, NE quad., outside D. Nixon's cube	76	24	555	< 1	0.007
2nd floor, NW quad., outside computer room	75.5	24	487	< 1	0.012
2nd floor, SW quad. outside H. Jones' cube	74	24	533	< 1	0.009
1st floor NE quad., warehouse	75	20	498	< 1	0.020
1st floor, SE quad., warehouse	69	26	375	< 1	0.012
1st floor, Emergency Preparedness office	75	14	460	< 1	0.011
1st floor, Training Room A	74	26	421	< 1	0.011
Outside Air, ground level	47	46	356	< 1	0.034

°F- Degrees Fahrenheit CO_2– Carbon Dioxide CO- Carbon Monoxide
ppm- parts per million mg/M^3- milligrams per cubic meter

4.0 HEALTH AND REGULATORY STANDARDS

4.1 Types of Standards

The Occupational Safety and Health Administration regulates worker exposure to toxic and hazardous substances and establishes airborne limits known as the Permissible Exposure Limits (PELs) as defined by 29 CFR 1910 Subpart Z, Toxic and Hazardous Substances. Compliance with the PEL is measured via 8-hour Time Weighted Averages (TWAs) and Short Term Exposure Limits (STELs). The OSHA standards represent the legally enforceable exposure limits as established by that federal regulatory agency. As a time weighted average exposure limit, OSHA considers that during an 8-hour shift, exposure periods in excess of the standard may be counterbalanced by an equivalent amount of exposure below the standard, and the average result would still be considered acceptable on a time-weighted basis.

The American Conference of Governmental Industrial Hygienists (ACGIH) annually recommends Threshold Limit Values (TLVs) and Short Term Exposure Limits (STELs) for exposures to a wide range of contaminants. The ACGIH also recommends certain Ceiling (C) limits for which exposure concentrations should never be exceeded. The PELs and the TLVs are most commonly expressed as 8-hour time-weighted average (TWA) occupational exposures. These represent conditions under which it is believed that workers may be repeatedly exposed, day after day, without adverse effect. These ACGIH guidelines are health-based recommendations. The National Institute for Occupational Safety and Health (NIOSH) also recommends health based exposure limits.

The NIOSH- and ACGIH-recommended levels are based on a preliminary set of health studies. It is generally accepted by the professional health community that occupational exposure standards are not designed totally to prevent adverse effects, but to limit their severity to the extent that irreversible harm will not occur. This approach does not provide protection to all sensitive individuals. Some people may exhibit individual sensitivities to a contaminant in the workplace in excess of the average response and may experience adverse health effects at exposure levels tolerated rather easily by other people.

STELs are the concentration to which workers can be exposed continuously for a short period of time (typically 15 minutes) without suffering from 1) excessive irritation, 2) chronic or irreversible tissue damage, or 3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self rescue, or materially reduce work efficiency, and provided that the daily PEL-TWA is not exceeded. The STEL is not a separate independent exposure limit; rather it supplements the TWA limit where there are recognized acute effects from a substance whose toxic effects are primarily of a chronic nature. STELs are instituted only where toxic effects have been reported from high short-term exposures in either humans or animals.

A STEL is defined as a 15-minute TWA exposure that should not be exceeded at any time during a workday even if the 8-hour TWA is within the limits. Exposures above the TWA up to the STEL should not be longer than 15 minutes and should not occur more than 4 times per day. There must also be 60 minutes between successive exposures in this range.

Ceiling concentrations are also established by both OSHA and ACGIH. Ceiling concentrations (usually established for irritant vapors and gases) are the concentrations that should not be exceeded during any part of the working exposure. Ceiling concentrations are preferably measured instantaneously. However, if this is not practical, than the ceiling may be assessed by sampling for a 15 minute period. TWAs permit an excursion over the PEL or TLV, during a work shift, provided that they are compensated by equivalent excursions below the PEL or TLV. Whereas the ceiling limit places a definite boundary that concentrations are not permitted to exceed. Thus, for comparison of measured values to the legal PEL limits, the full 8-hour time of a work shift must be included within the calculation of the exposure in order to compare validly the measured values with the legal standard.

4.2 Formaldehyde

This organic compound is a gas at normal room temperature, but may also exist in a volatile solid polymer form known as paraformaldehyde (a trimer). Formaldehyde is commonly used as a tissue preservative agent. Formaldehyde is a respiratory irritant, and at high exposure levels will cause severe irritation of the eyes, nose and throat. Exposure to low levels of formaldehyde has been found to induce changes in respiratory functions. The compound has been found to be an animal carcinogen and is considered to be a suspect human carcinogen. A widely used commercial compound, formaldehyde has ubiquitous sources in modern society in addition to its use as a tissue preservative.

The OSHA Permissible Exposure Limit (PEL) for formaldehyde is defined at 29 CFR 1910.1048. Exposure to formaldehyde must be limited to an 8-hour time weighted average (TWA) of less than 0.75 parts per million (ppm) and for a 15 minute Short Term Excursion Limit (STEL) to no more than 2 ppm. The American Conference of Governmental Industrial Hygienists (ACGIH) has designated the Threshold Limit Value (TLV) exposure limit as a ceiling limit of 0.3 ppm and indicated it as an A2 (Suspected Human) carcinogen in the 2002 TLV listings.

4.3 Hydrocarbons

Hydrocarbon is a general term given to compounds with a similar chemical structure that are often found in such materials as paints, solvents and wood preservatives. The specific occupational level as established by the Occupational Safety and Health Administration (OSHA) varies depending upon compound, but for example is 1,800 mg/M^3 for hexane and 435 mg/M^3 for xylenes.

For the total hydrocarbon result, the data are based upon a mixture of compounds present that are not separately identified. The quantification is performed by referencing the sum of intensity measurements for unknown gas chromatograph peaks to a hexane standard. For a mixture, no single molecular weight applies, so only a cumulative air concentration may be cited. No legal standard presently exists for total hydrocarbons.

NCC utilizes a guideline that total hydrocarbon levels above 1.0 mg/M^3 can cause adverse reactions in some sensitive individuals. Concentrations below this are generally not considered to be problematic.

4.4 Fungi

There are no federal standards limiting the concentration of fungal spores in indoor environments, in air or on surfaces. Comparison is typically made between the concentrations (the inside concentrations should be less than or equal to the outside concentration) and the "rank order" of the spores in the sample. This is a ranking of the spores by their prevalence in the sample and the inside and outside rank ordering should be similar.

There are no established dose-response data for exposure to mold spores; therefore, there can be no specific conclusions regarding health effects from such exposures. Certain individuals, including those with asthma, mold allergies, or the immuno-compromised are at greater risk from exposure. An individual's risk would have to be determined with the input of a qualified physician experienced in mold related issues.

4.5 Direct Reading Measurements

4.5.1 Carbon Dioxide

Carbon dioxide concentrations serve as an indicator of the ventilation system's ability to control human bioeffluents with dilution ventilation. The carbon dioxide concentration in a building is dependent on a number of variables including the occupant density and the amount of outside air introduced into the space. The American Society of Heating, Refrigerating and Air Conditioning Engineers has developed a standard for "Ventilation for Acceptable Indoor Air Quality (ASHRAE 62-1999)". In that standard, ASHRAE stated:

> "Human occupants produce carbon dioxide, water vapor, and contaminants including particulate matter, biological aerosols, and volatile organic compounds. Comfort (odor) criteria with respect to human bioeffluents are likely to be satisfied if the ventilation results in indoor CO_2 concentrations less than 700 ppm above the outdoor air concentration." (ASHRAE 62-1999, p. 10)

4.5.2 Carbon Monoxide

The OSHA PEL for carbon monoxide is 50 ppm for an 8 hour time weighted average. The 2002 ACGIH TLV for carbon monoxide is 25 ppm as an 8 hour TWA. ASHRAE recommends controlling indoor concentrations of carbon monoxide to less than 5 ppm.

4.5.3 Airborne Dusts

OSHA regulates exposures to dust as Particulates, Not Otherwise Regulated. The OSHA PEL for total dust exposures is 15 mg/M^3 for the total fraction and 5 mg/M^3 for the respirable fraction. The 2002 ACGIH TLV for Particulates, Not otherwise Specified is 10 mg/M^3 for the inhalable fraction and 3 mg/M^3 for the respirable fraction.

4.5.4 Temperature and Relative Humidity

There are no federal occupational health standards for compliance regarding temperature and relative humidity in a space such as an office building. These factors can vary widely without causing any adverse health effects among employees. However, moderate variation of temperature and humidity can result in considerable discomfort.

The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) has developed environmental guidelines for these factors based on 50 years of research with human subjects (Reference ASHRAE standard 62-1989). ASHRAE recommends that dry- and wet-bulb temperatures and relative humidity can vary but should remain within the "comfort zone". The comfort zone would be temperatures of approximately 68-75 °F in the winter with a relative humidity of not less than 20%, and 73-79 °F during the summer with a relative humidity of no more than 60%.

The National Institute for Occupational Safety and Health (NIOSH) has stated that the optimum range for relative humidity is 40-60%, and should be kept below 60% to prevent excessive microorganism growth. At very low humidity levels, mold spore formation is enhanced and particulates tend to irritate the upper respiratory tract. At very high humidities (>70%) mold growth is enhanced and allergic type responses are more likely to occur. Humidity should be kept within reasonable limits to avoid either of these two conditions.

5.0 DISCUSSION

Sampling results from laboratory-analyzed samples indicated that most measured parameters were within limits considered normal for indoor office settings. Most total hydrocarbon concentrations were well below NCC's recommended limit of 1 mg/M^3. There were two locations where measured hydrocarbon concentrations were slightly elevated compared to typical indoor settings. These locations included the 2^{nd} floor plotter area and a warehouse space in the northeast quadrant of the first floor. Inks or solvents associated with the operation and maintenance of the plotter may have impacted the sample collected from the 2^{nd} floor. Hydrocarbon concentrations were reduced relative to the 1992 survey. Trace quantities of formaldehyde were noted in the office spaces. These were well below applicable occupational exposure limits. The findings of trace concentrations of formaldehyde are consistent with the findings from the 1992 survey. Although all formaldehyde samples were less than the analytical limit of detection in 1992, the detection limit of the samples from this survey was lower compared with the earlier survey.

Measured carbon dioxide concentrations were within ASHRAE recommended limits. The findings from this current survey were consistent with the findings from the 1992 survey. Carbon monoxide was not detected. Measured temperatures were mostly within or the ASHRAE recommended comfort zone. Two locations had temperatures slightly above the upper ASHRAE comfort zone limit. Relative humidity measurements were mostly within recommended levels. Two locations had measured humidity below ASHRAE recommended limits. Measured dust concentrations were low in the office areas and lower than the concentration of dust measured in the outside air. The dust concentrations were consistent with the findings of the 1992 survey. The direct reading dust meter employed during this survey is more sensitive (has a lower limit of detection) relative to the gravimetric sampling and analysis method used in the 1992 survey.

Low concentrations of airborne fungal spores were noted in the office spaces. Usually, comparison is made between the concentrations (the inside concentrations should be less than or equal to the outside concentration) and the "rank order" of the spores in the sample. This is a ranking of the spores by their prevalence in the sample and the inside and outside rank ordering should be similar. However rank order comparisons cannot be made of findings of only a few spores. Measured concentrations were lower inside the building compared with the outside air. The types of spores found inside the building were generally consistent with the findings in the outside air. The airborne fungal spore results were consistent with the findings of the 1992 survey.

Stachybotrys fungi were detected in the air sample collected from the northeast quadrant of the second floor. The findings suggest that there may be a nearby source of moisture, since this fungus requires significant moisture (and a cellulose-rich medium) to grow. It was reported that there was a past history of moisture problems

in the training rooms located on the first floor, but that the moisture issues had been addressed. It is recommended that the area be checked carefully for signs of water intrusion.

Historically, there has been concern over *Stachybotrys* fungi, but current CDC guidance indicates that this mold should be treated like other molds. A copy of this CDC guidance is included for reference as an appendix to this report.

While there are no current published exposure limits for fungi, there were historic published values for *Stachybotrys* sp. fungi that can be used to place the findings from this investigation into perspective. The New York City Department of Health (NYCDOH) published a value of 1,000 to 10,000 colony forming units per cubic meter of air (CFU/m^3) or greater as a value that should indicate evacuation of an area should be considered. This was published in the 1993 version of "Guidelines on Assessment and Remediation of *Stachybotrys Atra* in Indoor Environments" (NYCDOH, May, 1993).

The 1,000-10,000 CFU/m^3 value was a measure that used sampling techniques that counted only culturable fungal spores (hence the term "colony forming units"). The techniques employed in this evaluation used methods that count spores using a microscope. All spores in an area of the slide are counted, regardless of whether they would grow on a culture plate. Therefore, the methods used to evaluate airborne concentrations of spores in this evaluation are more conservative than the techniques employed to measure concentrations against the 1993 NYCDOH guidelines. Nevertheless, the values measured in this survey are considerably lower than historical levels of concern.

A more recent publication by the American College of Occupational and Environmental Medicine (ACOEM) has provided an additional reference value to place in perspective the findings of airborne *Stachybotrys* sp. spores. This Evidence-based statement is titled "Adverse Human Health Effects Associated with Molds in the Indoor Environment" and was released by ACOEM on October 27, 2002. In this document, ACOEM published calculated airborne *Stachybotrys* sp. spore concentrations suggestive of a "no effect" subchronic (medium time frame) exposure. These values ranged from 9,400 Stachybotrys spores per cubic meter of air to about 68,000 Stachybotrys spores per cubic meter of air, depending on the age group, for a 24 hours per day, 7 days per week exposure.
(http://www.acoem.org/guidelines/article.asp?ID=52 Hyperlink date 3/4/03).

6.0 IEQ CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the investigation, NCC concluded that:

1) Most total hydrocarbon concentrations were within limits considered normal for indoor settings. Two areas including the 2nd floor plotter area and a 1st floor warehouse space slightly exceeded concentrations typically encountered in office settings. Total hydrocarbon concentrations were reduced relative to the 1992 survey.

2) Trace concentrations of formaldehyde were noted in the office areas. The measured concentrations were well below applicable occupational exposure standards. The formaldehyde concentrations were consistent with the findings of the 1992 survey.

3) Low concentrations of airborne fungal spores were noted in the office spaces. Measured concentrations were lower inside the building compared with the outside air. The types of spores found inside the building were generally consistent with the findings in the outside air. The airborne fungal spore results were consistent with the findings of the 1992 survey.

4) Carbon dioxide concentrations were within ASHRAE recommended limits. The carbon dioxide concentrations were consistent with the findings of the 1992 survey.

5) Carbon monoxide was not detected in the office areas.

6) Measured airborne dust concentrations in the office spaces were low and were slightly lower than the concentrations measured outside of the building. The airborne dust findings were consistent with the findings of the 1992 survey.

7) Most temperature measurements were within the recommended ASHRAE winter "comfort zone". Only two of sixteen indoor locations had measured temperatures slightly above the ASHRAE recommended comfort zone.

8) Most relative humidity measurements were within the recommended ASHRAE winter "comfort zone". Only two of sixteen indoor locations had measured relative humidity slightly below the ASHRAE recommended comfort zone.

Based on the results of the investigation, NCC recommends that:

1) The 2nd floor areas should be inspected for signs of moisture intrusion or accumulation.

2) It should be verified that the methods used to control moisture in the first floor training areas are effective in controlling the condensation that reportedly occurred during summer months.

HEATING, VENTILATION AND AIR CONDITIONING EVALUATION

7.0 INTRODUCTION

On January 29, 2003, an inspection and study of the heating, ventilation, and air conditioning (HVAC) systems serving the U. S. Army Corps of Engineers Waterfield Building, headquarters for the Norfolk District, Norfolk, Virginia was conducted. The goals of the study were as follows:

1. Inspect the central HVAC systems which serve the building.

2. Determine, for the systems inspected, the condition of the Air Handling Units (AHUs) and other pertinent system components.

3. Determine the percentage of ventilation air (outdoor air) in the supply air streams of these AHUs, and the total ventilation air supplied.

4. Determine, for the systems inspected, whether there are any defects in the HVAC equipment design, installation or in HVAC operational procedures which could be detrimental to employee health and safety.

5. Determine whether maintenance of the HVAC equipment is adequate.

6. Measure supply air quantities at random locations on the floor areas occupied by the Corps of Engineers. Compare measured supply air quantities with scheduled supply air quantities on Construction Drawings.

7. Determine the adequacy of the installed HVAC systems to meet the peak heating and cooling loads in the building.

8. Make recommendations as to corrective actions available to the Corps of Engineers to correct unsatisfactory aspects of the HVAC system, if any, as revealed by the study.

8.0 BACKGROUND

The Waterfield Building is a 4 story structure, with two mechanical penthouses on the roof. The building was designed in the late 1970s, and constructed in 1981 -1982. An addition was made to the north end of the building. The building is owned and maintained by the Corps of Engineers.

An inspection to evaluate the condition of HVAC systems was first conducted in October, 1992. Since that inspection, and the related report, the building and mechanical systems have undergone important changes. The large number of offices in the building has been reduced, and most the space was changed to cubicles. The control system for the HVAC systems was significantly changed. The HVAC systems were originally controlled through a Johnson Controls, Inc. JC-85 system. Several years after the inspection in 1992, a water pipe in the building ruptured, and sprayed water onto the main JC-85 control panel. It was apparently not possible or feasible to repair the panel, and it was replaced with a Trane Tracer EMCS. At approximately the same time, the capacity controls on the Air Handling Units, (AHUs), Return Air Fans (RAFs) and various chilled and hot water pumps and other equipment were converted to Variable Speed Drive systems, using ABB controllers.

The Facilities Engineer for the Corps of Engineers, Mr. Al Gates, reported that prior to the control system change and upgrade, he would receive as many as 40 calls in a day regarding HVAC control failures. After the control system change and upgrade, he would typically receive only one or two calls per month regarding equipment failures. He also reported there was no pattern of complaints regarding the temperature or humidity in the occupied space

Mr. Gates reported that on an annual basis, the AHU bag filters were changed, the cooling coils and interior of the casings were cleaned with a biocide recommended by the equipment manufacturer (Trane). This work had not been completed as of the time that the subject inspection occurred, on January 29, 2003.

It was reported that were excessive humidity problems in the spaces served by AHU-2. Mr. Gates reported that a major leak was discovered in the cooling coil. This leak was subsequently repaired. A fire damper in the supply air ductwork was found to have closed, and was re-opened. A thermostat was found to be defective, and was replaced. Mr. Gates also reported that there was a large split at a seam in the return air ductwork, on top of the duct. This was scheduled for repair. Mr. Gates indicated that the humidity problem in the AHU-2 zone had improved after partial repairs were made to AHU-2.

9.0 INSPECTION

The four occupied floors of the building were heated, ventilated, and air conditioned through five (5) main independent central-station air handling systems. Two AHUs, designated AHU-2 and 3 served the first floor area, AHU-4 served the warehouse area on the first floor, and 2 units, AHU-1 and AHU-5, were located in the Penthouse Mechanical Rooms, and served the office areas on the second, third and fourth floors. The second floor office areas which had been computer rooms were served by several computer room air conditioning systems.

The following data were obtained for these HVAC systems with the assistance of the Corps of Engineers Safety and Occupational Health Office and the building Engineering staff:

The two penthouse AHUs (AHU-1 and AHU-5) were alike in design. Each AHU was a draw through unit (the fan in the unit was located downstream of the cooling coil), with a chilled water cooling coil, high velocity flat pattern panel filters, a supply air fan and a return air fan. Each system had a mixing box, with outside air, and return air ducts connecting to the mixing box ahead of the air filter section. There was also an exhaust air duct upstream of the mixing box. Each AHU was connected to a ducted return air system which allowed return of air from the interior rooms of the building. The mixed outside and return air in the mixed air plenum section of the AHU was filtered by panel type pre-filters and bag type final filters. The air stream was drawn through the chilled water cooling coil, where it was cooled to 55 degrees F and dehumidified. (if the mixed air stream was at 55 degrees F as a result of cool outdoor air temperatures, then the cooling coil chilled water control valve was closed to prevent further cooling). The air then entered the supply air fan which discharged the conditioned air to the supply air ductwork.

The system operated as a variable volume system, in response to actual cooling load. Thermostats located in the rooms modulate air flow dampers in variable air volume (VAV) boxes connected to the supply air ductwork from the AHU. The VAV box dampers open as the thermostat controlling the VAV box senses a rise in room temperature above the setpoint. Similarly, as room temperature falls toward thermostat setpoint, the damper in the VAV box is modulated toward the closed (zero air flow) position.

Certain of the VAV boxes also contain hot water reheat coils, to provide heating of the controlled room or group of rooms.

As the VAV box dampers in the supply air system tend to modulate toward the closed position, the overall supply air requirement from the AHU will decrease. The reduction in air flow through the supply air ductwork will result in an increase in the static pressure in the supply air duct. A static pressure sensor in the supply air duct will detect this increase in static pressure. The static pressure sensor is connected to a pneumatic

controller which then modulates the overall airflow capacity of the AHU. This capacity control is achieved by closing inlet vanes at the AHU fan inlet. This reduces the total quantity of air supplied by the AHU fan. There are air flow measurement stations in the supply and return air ductwork. The data from these stations are used to determine the position of the return and exhaust air dampers, which are modulated to maintain the desired outdoor air quantity. A control signal is sent to the return air fans to modulate dampers at these fans to match the supply air fan flow (less the outdoor air flow). The systems operated continuously during building occupancy hours.

The conditioned air from the AHU was supplied to the room through low pressure duct work located in the ceiling plenum. Air discharged through linear slot diffusers, nominally 5 feet long, in the suspended ceiling grid. The supply ducts were galvanized steel, and were internally insulated.

Return air entered the ceiling plenum through troffers (slots) in the ceiling grid. The plenum air entered the mechanical rooms through transfer ducts. The return air entered the return air fan and was ducted to the AHU mixing box.

According to Corps of Engineers personnel, the AHUs are not operated overnight, nor are they operated over weekends. Start time for the AHUs has typically been approximately 5:00 AM, and the units run until 6:00 PM. The supply of chilled water to cooling coils is stopped at approximately 4:00 PM. The operation of the AHUs is controlled by a Trane Tracer Elite EMCS (Energy Management Control System) system interfaced with existing pneumatic operated dampers.

Air handling units AHU-2, AHU-3 and AHU-4 are constant volume units which provide cooling only (AHU-2 and AHU-3) or heating only (AHU-4).

Heating is provided through the use of hot water baseboard radiant heaters at the perimeter walls, and reheat coils in certain of the VAV boxes.

The three air handling units serving the 2nd floor computer room areas which were converted to office areas operate as follows: The return air stream from the office enters the air handling unit and is passed through a high efficiency air filter. The air stream is then drawn through a cooling and dehumidification coil, where the air is cooled to remove sensible heat (heat associated with a change in air temperature) and dehumidified to remove latent heat (heat associated with keeping moisture in air in a vapor state). The air stream then enters a reheat coil. The air stream is reheated to provide room temperature control. The air then passes through a humidifier (one of the units), which adds moisture to the dehumidified air so that the room relative humidity can be maintained at the desired value. These systems also include cooling coil bypass controls, which permit the cooling/dehumidification capacity of the unit to be matched to the actual loads in the computer room. The setpoint value for room air temperature and room air relative humidity is entered at a control panel on the unit. The conditioned air then enters the supply air fan section of the air handling unit. The fan discharges the

conditioned air to the computer room through diffusers which are installed in either a raised access floor. The AHU is designed to perform simultaneous cooling/dehumidification and reheating, as this type of HVAC system operation is necessary to provide precise control of room air temperature and relative humidity which is required in a computer room. There is no outdoor air supplied through the computer room AHUs.

10.0 HVAC EQUIPMENT INVENTORY

1) Zone Name: Main building, floors 2, 3, 4

Air Handling Unit: AHU-1

Fan Room: Penthouse

Serves: 2nd, 3rd and 4th floors, all but North addition

Date Inspected: January 29, 2003

Manufacturer: Trane

Model number: Series DT86J Draw Through

Serial Number: K81G29786

Estimated Design Minimum Outside Air Flow, CFM: 10,000

Specified Total Supply Air, CFM: 44,200

Approximate Number of Persons Served by AHU: 300

Outdoor Air Percentage in Supply Air: 45.3%

Space (Return Air) CO2, ppm: 527

Total Outside Air on date of test, CFM: N/A

Estimated Design Minimum Outside Air per Person, CFM: 33

Estimated Actual Outside Air per Person, CFM: 67

Air Filter Type: Panel, medium efficiency, also bag, high efficiency

Air Filter Condition: Clean

Air Filter Accessibility: Good

Cooling Coil Type: Chilled water

Cooling Coil Condition: Clean

Condensate Pan Condition: Needs to be cleaned

Ductwork Condition: Clean, dry

Noted system Deficiencies:

1. Return air fan RAF-1 has no inner side belt guard.
2. The guard rail at the duct shaft was missing.
3. Duct insulation was loose on return air duct system.

2) Zone Name: 1st floor, South

Air Handling Unit: AHU-2

Fan Room: 1st Floor Mechanical Room

Serves: 1st floors, South area

Date Inspected: January 29, 2003

Manufacturer: N/A

Model number: N/A

Serial Number: N/A

Estimated Design Minimum Outside Air Flow, CFM: 3,300

Approximate Number of Persons Served by AHU: 20

Outdoor Air Percentage in Supply Air: 49.3%

Space (Return Air) CO2, ppm: 382

Total Outside Air on date of test, CFM: N/A

Estimated Design Minimum Outside Air per Person, CFM: N/A

Estimated Actual Outside Air per Person, CFM: N/A

Air Filter Type: N/A

Air Filter Condition: N/A

Air Filter Accessibility: Poor

Cooling Coil Type: Chilled Water

Cooling Coil Condition: N/A

Condensate Pan Condition: N/A

Ductwork Condition: N/A

Noted system Deficiencies:

1. AHU was virtually inaccessible.
2. Return air duct split.

3) Zone Name: 1st floor, West

Air Handling Unit: AHU-3

Fan Room: 1st Floor Mechanical Room

Serves: 1st floor, West areas

Date Inspected: January 29, 2003

Manufacturer: N/A

Model number: N/A

Serial Number: N/A

Estimated Design Minimum Outside Air Flow, CFM: 1,000

Approximate Number of Persons Served by AHU: 10

Outdoor Air Percentage in Supply Air: N/A

Space (Return Air) CO2, ppm: N/A

Total Outside Air on date of test, CFM: N/A

Estimated Design Minimum Outside Air per Person, CFM: N/A

Estimated Actual Outside Air per Person, CFM: N/A

Air Filter Type: N/A

Air Filter Condition: N/A

Air Filter Accessibility: Poor

Heating Coil Type: Hot Water

Heating Coil Condition: N/A

Ductwork Condition: N/A

Noted system Deficiencies:

1. AHU was virtually inaccessible.
2. AHU has not been used for a number of years.

4) Zone Name: 1st Floor, East (Warehouse)

Air Handling Unit: AHU-4

Fan Room: 1st floor ceiling

Serves: 1st floor Warehouse area

Date Inspected: January 29, 2003

Manufacturer: Trane

Model number: N/A

Serial Number: N/A

Estimated Design Minimum Outside Air Flow, CFM: 0

Approximate Number of Persons Served by AHU: 1

Outdoor Air Percentage in Supply Air: N/A

Space (Return Air) CO2, ppm: N/A

Total Outside Air on date of test, CFM: N/A

Estimated Design Minimum Outside Air per Person, CFM: 0

Estimated Actual Outside Air per Person, CFM: N/A

Air Filter Type: Panel, medium efficiency

Air Filter Condition: Clean

Air Filter Accessibility: Fair

Heating Coil Type: Hot water

Heating Coil Condition: Clean

Ductwork Condition: Clean, dry

Noted system Deficiencies:

1. Access to unit was poor.

5) Zone Name: Building addition (North end), floors 1, 2, 3, 4

Air Handling Unit: AHU-5

Fan Room: Penthouse

Serves: Building addition (North end), floors 1, 2, 3, 4

Date Inspected: January 29, 2003

Manufacturer: Trane

Model number: Series CCDB35KH0C Draw Through

Serial Number: K82F61549

Specified Supply Air Quantity, CFM: 18,300

Estimated Design Minimum Outside Air Flow, CFM: 2,800

Approximate Number of Persons Served by AHU: 100

Outdoor Air Percentage in Supply Air: 56.0%

Space (Return Air) CO2, ppm: 466

Total Outside Air on date of test, CFM: N/A

Estimated Design Minimum Outside Air per Person, CFM: N/A

Estimated Actual Outside Air per Person, CFM: N/A

Air Filter Type: Panel, medium efficiency, also bag, high efficiency

Air Filter Condition: Clean

Air Filter Accessibility: Good

Cooling Coil Type: Chilled water

Cooling Coil Condition: Clean

Condensate Pan Condition: Needs to be cleaned

Ductwork Condition: Clean, dry

Noted system Deficiencies:

1. Return air fan RAF-5 had no inner side belt guard.
2. Water leaking from cooling coil. Coil may be freeze damaged.

6) Zone Name: IMO Computer Room

Air Handling Unit: CAC-1

Fan Room: In former NAD Computer Room

Serves: Former NAD Computer Room

Date Inspected: January 29, 2003

Manufacturer: Compu-Aire

Model number: System 2000

Serial Number: N/A

Estimated Design Minimum Outside Air Flow, CFM: 0

Approximate Number of Persons Served by AHU: 3

Outdoor Air Percentage in Supply Air: 0%

Total Outside Air on date of test, CFM: 0

Estimated Design Minimum Outside Air per Person, CFM: 0

Estimated Actual Outside Air per Person, CFM: 0

Air Filter Type: Panel, medium efficiency

Air Filter Condition: Clean

Air Filter Accessibility: Good

Cooling Coil Type: Direct Expansion

Cooling Coil Condition: Clean

Condensate Pan Condition: Clean

Noted system Deficiencies:

1. Excessive supply air velocity at floor diffusers.
2. No outside air supplied.

7) Zone Name: IMO Office Area

Air Handling Unit: CAC-2

Fan Room: In former NAD Computer Room

Serves: IMO Office Area

Date Inspected: January 29, 2003

Manufacturer: Liebert

Model number: FD192G

Serial Number: 43199B

Estimated Design Minimum Outside Air Flow, CFM: 0

Approximate Number of Persons Served by AHU: 3

Outdoor Air Percentage in Supply Air: 0%

Total Outside Air on date of test, CFM: 0

Estimated Design Minimum Outside Air per Person, CFM: 0

Estimated Actual Outside Air per Person, CFM: 0

Air Filter Type: Panel, medium efficiency

Air Filter Condition: Clean

Air Filter Accessibility: Good

Cooling Coil Type: Direct Expansion

Cooling Coil Condition: Clean

Condensate Pan Condition: Clean

Noted system Deficiencies:

1. Excessive supply air velocity at floor diffusers.
2. Some diffusers were blocked by carpeting.
3. No outside air supplied.

8) Zone Name: Contracting Office

Air Handling Unit: CAC-3

Fan Room: In former NAO Computer Room

Serves: Contracting Office

Date Inspected: January 29, 2003

Manufacturer: Data Aire

Model number: DAGD-0834

Serial Number: 2000-6136-A

Estimated Design Minimum Outside Air Flow, CFM: 0

Approximate Number of Persons Served by AHU: 8

Outdoor Air Percentage in Supply Air: 0%

Total Outside Air on date of test, CFM: 0

Estimated Design Minimum Outside Air per Person, CFM: 0

Estimated Actual Outside Air per Person, CFM: 0

Air Filter Type: Panel, medium efficiency

Air Filter Condition: Clean

Air Filter Accessibility: Good

Cooling Coil Type: Direct Expansion

Cooling Coil Condition: Clean

Condensate Pan Condition: Clean

Noted system Deficiencies:

1. No outside air supplied.

Actual percentages of outdoor air in the supply air stream were determined using the dry bulb temperature ratio method. These percentage values were then multiplied by the measured supply air flows from the AHU control system to determine actual AHU outdoor air CFM. This method was used due to the absence of acceptable locations for accurate duct velocity traverses.

The design of AHU-2A was reviewed. The final submission contract documents (Drawings and Specifications) were reviewed. This system was designed to replace the existing AHU-2. The design was a VAV unit which incorporated all new supply and return air ductwork, with fan powered VAV terminals. The design also incorporated a space CO2 monitoring system which was used to monitor the CO2 concentration in the rooms served by the VAV terminals. The design was considered satisfactory, and should provide good temperature control and good general indoor air quality. There were some issues which should be addressed by the designer:

1. How is the construction to be staged? Is it assumed that the area will be closed and isolated from the rest of the building, or will the construction be performed while some operations continue in the area served by AHU-2A?

2. Is the highest interior space CO2 concentration used to control the outdoor air volume at the AHU, or are the individual interior space CO2 concentrations averaged to establish a feedback signal to the AHU-2A controller?

11.0 TYPICAL AIRFLOW MEASUREMENTS

Air flow measurements were made using an Alnor Model 150 digital flow hood with real time flow rate averaging.

Floor	Area Column Designation	CFM on Drawings	Measured CFM
2	Between 7 and 8, D and E	46	70
2	Between 7 and 8, AA and A	155	105
2	Between 10 and 11, H and G	175	72
2	Between 10 and 11, AA and A	N/A	N/A
3	Between 7 and 8, D and E	46	<50
3	Between 7 and 8, AA and A	140	152
3	Between 10 and 11, H and G	150	57
3	Between 10 and 11, AA and A	140	104
4	Between 7 and 8, D and E	60	57
4	Between 7 and 8, AA and A	160	100
4	Between 10 and 11, H and G	170	140
4	Between 10 and 11,	160	95

AA and A

The room temperatures in the areas tested were all in the range of 70 to 75 degrees. This was an indication that the VAV terminals were maintaining room temperature setpoint while operating at less than maximum flow rate.

12.0 HVAC CONCLUSIONS

1. In general, the penthouse central HVAC systems serving the building (AHU-1 and AHU-5) were well designed and installed. The systems were well maintained. The air filters were of adequate efficiency and were clean. All cooling coils were in clean condition, however the condensate pans were in need of cleaning. This was scheduled for shortly after the inspection.

2. The two AHUs located in the southeast fan room (AHU-2 and AHU-3) were virtually inaccessible. The lack of access makes it difficult or impossible to maintain the units, depending on the location of the component to be maintained. AHU-3 is apparently abandoned.

3. The design capacity of the AHUs should meet or exceed the minimum 20 CFM per person of outdoor air CFM, in accordance with ASHRAE Standard 62. All of the central station AHUs which could be tested were found to be supplying outdoor air in excess of the minimum design quantities. This was due to the cool weather conditions on the date of the inspection, which permitted the enthalpy economizer control to open the outside air dampers to bring more than the minimum outdoor air into the AHU. The computer room AHUs were not, however, providing any outside air to the conditioned spaces.

4. Employees reported that noise and drafts associated with the computer room AHU in the former NAO Computer Room were excessive. The air flow measurements and load calculations indicated that there was far more cooling capacity (approximately 12.5 tons cooling) in the computer room AHU than was necessary for the room, even on a peak cooling load day. The air flow tests indicate that some portion of the supply air flow is leaking to unconditioned spaces. From an energy conservation standpoint it is not cost effective to operate this highly oversized unit, particularly if reheat is required for temperature control.

5. There have been no significant complaints of temperature control problems in the building. This is attributed to the improvements in the HAVC control systems since the previous inspection.

6. The addition of CO2 monitoring provides a good surrogate measurement for indoor air quality. The low CO2 readings on the date of the inspection is an indication that the volume of outside air supplied is satisfactory.

13.0 HVAC RECOMMENDATIONS

1. It is recommended that all of the Noted System Deficiencies listed in the above HVAC Equipment Inventory be corrected. The scheduled AHU cleaning should be completed before the cooling season begins.

2. It is recommended that humidification systems be provided for AHU-1 and AHU-5. The systems should be capable of maintaining a minimum of 35% relative humidity in the building based on 100% economizer operation in winter. The system should include room humidistats, a high limit humidistat in the supply air ductwork and an air flow proving device interlock with the humidification system water/steam supply.

NUCHEMCO

APPENDIX A

Laboratory Analysis Reports

Account#: 7057 **Name:** NUCHEMCO, INC **Address:** POB 50632 ARLINGTON VA, 22205 **Phone:** 703-535-3180		**Laboratory Result Report** American Medical Laboratories 14255 Newbrook Drive Chantilly, VA 20153 (703) 802-6900 (800) 336-3718
Patient: COE-03-2, **MRN:** 182108 **SSN:** **Address:** NUCHEMCO, INC ATTN: NEIL JURINSKI, PHD 5764-B BURKE VA, 22015	**Sex:** **DOB:** **Room/Bed::** **Pt. Work #:** **Pt. Home #:** **Report Status:** Finalized	**Physician:** PHYSICIAN, STAFF **Physician ID:** 7057 **Order No:** 1606692 **Order Date:** 02/04/2003 **Lab ID:** 182108 **Collection Date:**

Report Notes:

Test Code	Test Name	Result	Reference Range	Units	Result Date/Time

IHT1 - IHTEST — 02/04/03 08:38 AM

IHTEST

```
AML NUMBER----------------------VALUE-----UNITS--------------------
8794118  030129-1 JJ           ADSORPTION TUBE
6260  FORMALDEHYDE (50-00-0)
DATE OF COLLECTION:   1-29-03
AIR VOLUME:           158       Liters
MASS:                 1.1       ug
QUANTITATION LIMIT:   0.18      ug
CONCENTRATION:        0.0058    ppm
ANALYST:              Maria Marino
8794119  030129-2 JJ           ADSORPTION TUBE
6260  FORMALDEHYDE (50-00-0)
DATE OF COLLECTION:   1-29-03
AIR VOLUME:           154       Liters
MASS:                 0.88      ug
QUANTITATION LIMIT:   0.18      ug
CONCENTRATION:        0.0046    ppm
ANALYST:              Maria Marino
8794120  030129-3 JJ           ADSORPTION TUBE
6260  FORMALDEHYDE (50-00-0)
DATE OF COLLECTION:   1-29-03
AIR VOLUME:           152       Liters
MASS:                 1.1       ug
QUANTITATION LIMIT:   0.18      ug
CONCENTRATION:        0.0061    ppm
ANALYST:              Maria Marino
8794121  030129-4 JJ           ADSORPTION TUBE
6260  FORMALDEHYDE (50-00-0)
DATE OF COLLECTION:   1-29-03
AIR VOLUME:           152       Liters
MASS:                 1.1       ug
QUANTITATION LIMIT:   0.18      ug
CONCENTRATION:        0.0057    ppm
ANALYST:              Maria Marino
8794122  030129-5 JJ           ADSORPTION TUBE
6260  FORMALDEHYDE (50-00-0)
DATE OF COLLECTION:   1-29-03
MASS:                 Less than quantitation limit.
QUANTITATION LIMIT:   0.18      ug
ANALYST:              Maria Marino
NOTATIONS
The calculation of analyte concentrations is based on
information (i.e. air volumes, exposure times, areas,
```

IHT2 - IHTEST — 02/04/03 08:38 AM

IHTEST

```
AML NUMBER----------------------VALUE-----UNITS--------------------
etc.) provided by the client.
.
```

Account#: 7057 **Name:** NUCHEMCO, INC **Address:** POB 50632 ARLINGTON VA, 22205 **Phone:** 703-535-3180		**Laboratory Result Report** American Medical Laboratories 14255 Newbrook Drive Chantilly, VA 20153 (703) 802-6900 (800) 336-3718
Patient: COE-03-2, **MRN:** 182108 **SSN:** **Address:** NUCHEMCO, INC ATTN: NEIL JURINSKI, PHD 5764-B BURKE VA, 22015	**Sex:** **DOB:** **Room/Bed::** **Pt. Work #:** **Pt. Home #:** **Report Status:** Finalized	**Physician:** PHYSICIAN, STAFF **Physician ID:** 7057 **Order No:** 1606692 **Order Date:** 02/04/2003 **Lab ID:** 182108 **Collection Date:**

Report Notes:

Test Code	Test Name	Result	Reference Range	Units	Result Date/Time

Unless otherwise noted in the report above, the results for the samples have not been corrected for background contamination, if found, in analysis blanks.

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Samples are desorbed in the appropriate desorption solution and assayed via HPLC using NIOSH 2016 as a reference method.

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The current OSHA Permissible Exposure Limit, (PEL), for formaldehyde is 0.75 ppm as an 8 hour Time Weighted Average (TWA). ACGIH lists a ceiling level of 0.3 ppm for formaldehyde.
The short term exposure limit (STEL) for formaldehyde is 2 ppm for 15 minutes.

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*** FINAL REPORT ***

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CHRISTOPHER KASE, CAIH
DIRECTOR, IND. HYGIENE

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FOR INDUSTRIAL HYGIENE RELATED QUESTIONS, INCLUDING REQUESTS FOR SUPPLIES, CALL 1-800-348-1590

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*** END OF REPORT ***

Account#: 7057 **Name:** NUCHEMCO, INC **Address:** POB 50632 ARLINGTON VA, 22205 **Phone:** 703-535-3180		**Laboratory Result Report** American Medical Laboratories 14255 Newbrook Drive Chantilly, VA 20153 (703) 802-6900 (800) 336-3718
Patient: COE-03-2, **MRN:** 182109 **SSN:** **Address:** NUCHEMCO, INC ATTN: NEIL JURINSKI, PHD 5764-B BURKE VA, 22015	**Sex:** **DOB:** **Room/Bed::** **Pt. Work #:** **Pt. Home #:** **Report Status:** Finalized	**Physician:** PHYSICIAN, STAFF **Physician ID:** 7057 **Order No:** 1600551 **Order Date:** 02/03/2003 **Lab ID:** 182109 **Collection Date:**

Report Notes:

Test Code	Test Name	Result	Reference Range	Units	Result Date/Time

IHT1 - IHTEST — 02/03/03 08:24 AM

IHTEST

```
AML NUMBER----------------------VALUE-----UNITS--------------------
8794123  030129-6 JJ           CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  29.3      ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.188     mg/M3
ANALYST:               R. Kenneth Petrie
8794124  030129-7 JJ           CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  13        ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.083     mg/M3
ANALYST:               R. Kenneth Petrie
8794125  030129-8 JJ           CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  12        ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.077     mg/M3
ANALYST:               R. Kenneth Petrie
8794126  030129-9 JJ           CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  57.7      ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.370     mg/M3
ANALYST:               R. Kenneth Petrie
8794127  030129-10 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  16.3      ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.104     mg/M3
ANALYST:               R. Kenneth Petrie
8794128  030129-11 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  12        ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.075     mg/M3
ANALYST:               R. Kenneth Petrie
8794129  030129-12 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  13        ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.075     mg/M3
```

IHT2 - IHTEST — 02/03/03 08:24 AM

IHTEST

```
AML NUMBER----------------------VALUE-----UNITS--------------------
ANALYST:               R. Kenneth Petrie
8794130  030129-13 JJ          CHARCOAL TUBE
```

Account#: 7057 **Name:** NUCHEMCO, INC **Address:** POB 50632 ARLINGTON VA, 22205 **Phone:** 703-535-3180		**Laboratory Result Report** American Medical Laboratories 14255 Newbrook Drive Chantilly, VA 20153 (703) 802-6900 (800) 336-3718
Patient: COE-03-2, **MRN:** 182109 **SSN:** **Address:** NUCHEMCO, INC ATTN: NEIL JURINSKI, PHD 5764-B BURKE VA, 22015	**Sex:** **DOB:** **Room/Bed::** **Pt. Work #:** **Pt. Home #:** **Report Status:** Finalized	**Physician:** PHYSICIAN, STAFF **Physician ID:** 7057 **Order No:** 1600551 **Order Date:** 02/03/2003 **Lab ID:** 182109 **Collection Date:**

Report Notes:

Test Code	Test Name	Result	Reference Range	Units	Result Date/Time

```
1583  TOTAL HYDROCARBONS
MASS:                  17.9      ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.108     mg/M3
ANALYST:               R. Kenneth Petrie
8794131  030129-14 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  232       ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         1.39      mg/M3
ANALYST:               R. Kenneth Petrie
8794132  030129-15 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  33.3      ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.204     mg/M3
ANALYST:               R. Kenneth Petrie
NOTATIONS
The calculation of analyte concentrations is based on
information (i.e. air volumes, exposure times, areas,
etc.) provided by the client.
.
Unless otherwise noted in the report above, the results
for the samples have not been corrected for background
contamination, if found, in analysis blanks.
.
Total hydrocarbons is a semi-quantitative measure of
the total amount of volatile hydrocarbons on a sample
compared to n-hexane.
.
*** FINAL REPORT ***
```

IHT3 - IHTEST 02/03/03 08:24 AM

IHTEST

```
AML NUMBER----------------------VALUE-----UNITS--------------------
CHRISTOPHER KASE, CAIH
DIRECTOR, IND. HYGIENE
.
.
FOR INDUSTRIAL HYGIENE RELATED QUESTIONS,
INCLUDING REQUESTS FOR SUPPLIES, CALL
1-800-348-1590
.
.
*** END OF REPORT ***
```

Account#: 7057 **Name:** NUCHEMCO, INC **Address:** POB 50632 ARLINGTON VA, 22205 **Phone:** 703-535-3180		**Laboratory Result Report** American Medical Laboratories 14255 Newbrook Drive Chantilly, VA 20153 (703) 802-6900 (800) 336-3718
Patient: COE-03-2, **MRN:** 182110 **SSN:** **Address:** NUCHEMCO, INC ATTN: NEIL JURINSKI, PHD 5764-B BURKE VA, 22015	**Sex:** **DOB:** **Room/Bed::** **Pt. Work #:** **Pt. Home #:** **Report Status:** Finalized	**Physician:** PHYSICIAN, STAFF **Physician ID:** 7057 **Order No:** 1600557 **Order Date:** 02/03/2003 **Lab ID:** 182110 **Collection Date:**

Report Notes:

Test Code	Test Name	Result	Reference Range	Units	Result Date/Time

IHT1 - IHTEST — 02/03/03 08:25 AM

IHTEST

```
AML NUMBER----------------------VALUE-----UNITS--------------------
8794133  030129-16 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  11        ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.071     mg/M3
ANALYST:               R. Kenneth Petrie
8794134  030129-17 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  24.5      ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.159     mg/M3
ANALYST:               R. Kenneth Petrie
8794135  030129-18 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  9.1       ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.096     mg/M3
ANALYST:               R. Kenneth Petrie
8794136  030129-19 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  12        ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.13      mg/M3
ANALYST:               R. Kenneth Petrie
8794137  030129-20 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  189       ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         2.03      mg/M3
ANALYST:               R. Kenneth Petrie
8794138  030129-21 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  5.5       ug
QUANTITATION LIMIT:    1.6       ug
CONCENTRATION:         0.059     mg/M3
ANALYST:               R. Kenneth Petrie
8794139  030129-22 JJ          CHARCOAL TUBE
1583  TOTAL HYDROCARBONS
MASS:                  Less than quantitation limit.
QUANTITATION LIMIT:    1.6       ug
ANALYST:               R. Kenneth Petrie
```

IHT2 - IHTEST — 02/03/03 08:25 AM

IHTEST

```
AML NUMBER----------------------VALUE-----UNITS--------------------
NOTATIONS
The calculation of analyte concentrations is based on
```

Account#: 7057 **Name:** NUCHEMCO, INC **Address:** POB 50632 ARLINGTON VA, 22205 **Phone:** 703-535-3180		**Laboratory Result Report** American Medical Laboratories 14255 Newbrook Drive Chantilly, VA 20153 (703) 802-6900 (800) 336-3718
Patient: COE-03-2, **MRN:** 182110 **SSN:** **Address:** NUCHEMCO, INC ATTN: NEIL JURINSKI, PHD 5764-B BURKE VA, 22015	**Sex:** **DOB:** **Room/Bed::** **Pt. Work #:** **Pt. Home #:** **Report Status:** Finalized	**Physician:** PHYSICIAN, STAFF **Physician ID:** 7057 **Order No:** 1600557 **Order Date:** 02/03/2003 **Lab ID:** 182110 **Collection Date:**

Report Notes:

Test Code	Test Name	Result	Reference Range	Units	Result Date/Time

information (i.e. air volumes, exposure times, areas, etc.) provided by the client.

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Unless otherwise noted in the report above, the results for the samples have not been corrected for background contamination, if found, in analysis blanks.

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Total hydrocarbons is a semi-quantitative measure of the total amount of volatile hydrocarbons on a sample compared to n-hexane.

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*** FINAL REPORT ***

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CHRISTOPHER KASE, CAIH
DIRECTOR, IND. HYGIENE

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FOR INDUSTRIAL HYGIENE RELATED QUESTIONS, INCLUDING REQUESTS FOR SUPPLIES, CALL 1-800-348-1590

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*** END OF REPORT ***

AEROBIOLOGY LABORATORY
ASSOCIATES, INCORPORATED
MICROBIOLOGY SPECIALISTS

Certificate of Laboratory Analysis

NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 1 of 21
Job ID: 03 0569

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Certificate of Laboratory Analysis

NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003

Job ID: 03 0569

Client Sample Number: 030129-23JJ
Lab Sample Number: 03 0569-01
Sampling Location: Outside Air, Roof
Date Collected: 1/29/2003
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium	11	Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes	11	Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless	11	Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements	11	Spores/m 3
Torula herbarum	11	Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Algae	33	Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: 88 **Spores/m 3**

Detection Limits: 11 Spores/m3

Large amount of particulate observed.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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Certificate of Laboratory Analysis

NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 3 of 21
Job ID: 03 0569

Client Sample Number: 030129-24JJ
Sampling Location: 4th Floor, SE
Date Collected: 1/29/2003

Lab Sample Number: 03 0569-02
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores	11	Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: 11 Spores/m 3

Detection Limits: 11 Spores/m3

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 4 of 21
Job ID: 03 0569

Client Sample Number: 030129-25JJ
Sampling Location: 4th Floor, NE
Date Collected: 1/29/2003

Lab Sample Number: 03 0569-03
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless	11	Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: 11 **Spores/m 3**

Detection Limits: 11 Spores/m3

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 5 of 21
Job ID: 03 0569

Client Sample Number: 030129-26JJ
Sampling Location: 4th Floor, NW
Date Collected: 1/29/2003

Lab Sample Number: 03 0569-04
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium	22	Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: 22 Spores/m 3

Detection Limits: 11 Spores/m3

Large amount of particulate observed.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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NuChemCo, Inc.
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Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 6 of 21
Job ID: 03 0569

Client Sample Number: 030129-27JJ
Sampling Location: 4th Floor, SW
Date Collected: 1/29/2003

Lab Sample Number: 03 0569-05
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements	11	Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: 11 **Spores/m 3**

Detection Limits: 11 Spores/m3

Large amount of particulate observed.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 7 of 21
Job ID: 03 0569

Client Sample Number: 030129-28JJ
Sampling Location: 3rd Floor, SE
Date Collected: 1/29/2003

Lab Sample Number: 03 0569-06
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: **<11 Spores/m 3** **Spores/m 3**

Detection Limits: 11 Spores/m3

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 8 of 21
Job ID: 03 0569

Client Sample Number: 030129-29JJ
Lab Sample Number: 03 0569-07
Sampling Location: 3rd Floor, NW
Date Collected: 1/29/2003
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: **<11 Spores/m 3** **Spores/m 3**

Detection Limits: 11 Spores/m3

Large amount of fibers and particulate observed.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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Certificate of Laboratory Analysis

NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 9 of 21
Job ID: 03 0569

Client Sample Number: 030129-30JJ
Lab Sample Number: 03 0569-08
Sampling Location: 3rd Floor, NE
Date Collected: 1/29/2003
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes	11	Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: 11 Spores/m 3

Detection Limits: 11 Spores/m3

Large amount of fibers and particulate observed.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

AEROBIOLOGY LABORATORY ASSOCIATES, INCORPORATED
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Certificate of Laboratory Analysis

NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 10 of 21
Job ID: 03 0569

Client Sample Number: 030129-31JJ
Sampling Location: 3rd Floor, SW
Date Collected: 1/29/2003

Lab Sample Number: 03 0569-09
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes	11	Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group	22	Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: 33 **Spores/m 3**

Detection Limits: 11 Spores/m3

Large amount of fibers and particulate observed.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

AEROBIOLOGY LABORATORY ASSOCIATES, INCORPORATED
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Certificate of Laboratory Analysis

NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 11 of 21
Job ID: 03 0569

Client Sample Number: 030129-32JJ
Sampling Location: 2nd Floor, SE
Date Collected: 1/29/2003

Lab Sample Number: 03 0569-10
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium	11	Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements	11	Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: 22 Spores/m 3

Detection Limits: 11 Spores/m3

Large amount of fibers and particulate observed.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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Certificate of Laboratory Analysis

NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 12 of 21
Job ID: 03 0569

Client Sample Number: 030129-33JJ
Sampling Location: 2nd Floor, NE
Date Collected: 1/29/2003

Lab Sample Number: 03 0569-11
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys	44	Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements	11	Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: **55** **Spores/m 3**

Detection Limits: 11 Spores/m3

Large amount of fibers and particulate observed.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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Certificate of Laboratory Analysis

NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 13 of 21
Job ID: 03 0569

Client Sample Number: 030129-34JJ
Sampling Location: 2nd Floor, NW
Date Collected: 1/29/2003

Lab Sample Number: 03 0569-12
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores	11	Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: 11 Spores/m 3

Detection Limits: 11 Spores/m3

Large amount of fibers and particulate observed.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

AEROBIOLOGY LABORATORY ASSOCIATES, INCORPORATED
MICROBIOLOGY SPECIALISTS

Certificate of Laboratory Analysis

NuChemCo, Inc.
5765-F Burke Centre Parkway, #149
Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 14 of 21
Job ID: 03 0569

Client Sample Number: 030129-35JJ
Sampling Location: 2nd Floor, SW
Date Collected: 1/29/2003

Lab Sample Number: 03 0569-13
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: **<11 Spores/m 3** **Spores/m 3**

Detection Limits: 11 Spores/m3

Large amount of fibers and particulate observed.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 15 of 21
Job ID: 03 0569

Client Sample Number: 030129-36JJ **Lab Sample Number:** 03 0569-14
Sampling Location: 1st Floor, NE, Warehouse
Date Collected: 1/29/2003 **Volume/Area:** 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes	11	Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown	11	Spores/m 3
Hyphal Elements	11	Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: **33** **Spores/m 3**

Detection Limits: 11 Spores/m3

Spore count may be underestimated due to heavy particulate.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 16 of 21
Job ID: 03 0569

Client Sample Number: 030129-37JJ **Lab Sample Number:** 03 0569-15
Sampling Location: 1st Floor, SE, Warehouse
Date Collected: 1/29/2003 **Volume/Area:** 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores	22	Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group	11	Spores/m 3
Algae	33	Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: **66** **Spores/m 3**

Detection Limits: 11 Spores/m3

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003

Job ID: 03 0569

Client Sample Number: 030129-38JJ **Lab Sample Number:** 03 0569-16
Sampling Location: 1st Floor, NW, Emerg. Prep.
Date Collected: 1/29/2003 **Volume/Area:** 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements	22	Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: **22** **Spores/m 3**

Detection Limits: 11 Spores/m3

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 18 of 21
Job ID: 03 0569

Client Sample Number: 030129-39JJ
Lab Sample Number: 03 0569-17
Sampling Location: 1st Floor, Training A
Date Collected: 1/29/2003
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3
TOTAL SPORES:	**<11 Spores/m 3**	**Spores/m 3**

Detection Limits: 11 Spores/m3

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003
Page 19 of 21
Job ID: 03 0569

Client Sample Number: 030129-40JJ
Lab Sample Number: 03 0569-18
Sampling Location: Outside Air, Ground
Date Collected: 1/29/2003
Volume/Area: 90 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium	22	Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes	44	Spores/m 3
Penicillium/Aspergillus group	33	Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements	22	Spores/m 3
Torula herbarum	11	Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: 132 **Spores/m 3**

Detection Limits: 11 Spores/m3

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003

Job ID: 03 0569

Client Sample Number: 030129-41JJ
Lab Sample Number: 03 0569-19
Sampling Location: Field Blank
Date Collected: 1/29/2003
Volume/Area: 0 L

TEST REQUESTED: 1054 NON-VIABLE, Spore Trap Analysis

SPORE IDENTIFICATION	RESULTS	UNITS
Cladosporium		Spores/m 3
Ascospores		Spores/m 3
Basidiospores		Spores/m 3
Smuts, Periconia, Myxomycetes		Spores/m 3
Penicillium/Aspergillus group		Spores/m 3
Alternaria		Spores/m 3
Drechslera / Bipolaris group		Spores/m 3
Colorless		Spores/m 3
Arthrinium		Spores/m 3
Curvularia		Spores/m 3
Stachybotrys		Spores/m 3
Trichocladium		Spores/m 3
Unknown		Spores/m 3
Hyphal Elements		Spores/m 3
Torula herbarum		Spores/m 3
Geotrichum		Spores/m 3
Epicoccum		Spores/m 3
Pithomyces		Spores/m 3
Chaetomium		Spores/m 3
Ulocladium		Spores/m 3
Rusts		Spores/m 3
Clear brown		Spores/m 3

TOTAL SPORES: **<11 Spores/m 3** **Spores/m 3**

Detection Limits: 11 Spores/m3

Detection Limit = 0 when a field blank is submitted.

Date Analyzed: 2/3/2003

Analyst: Debra Gulick, B.S., MT (ASCP)

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Burke , VA 22015-2233
Attn: Neil Jurinski
Project: COE-03-2
Condition of Sample: Acceptable

Date Received: 1/30/2003
Date Reported: 2/3/2003

Job ID: 03 0569

Results relate only to the items tested.

Suzanne S. Blevins, B.S., SM (ASCP)
Laboratory Director

NUCHEMCO

APPENDIX B

CDC Information

Questions and Answers on *Stachybotrys chartarum* and other molds

- Q 1. I heard about toxic molds that grow in homes and other buildings. Should I be concerned about a serious health risk to me and my family?

  A. The hazards presented by molds that may contain mycotoxins should be considered the same as other common molds which can grow in your house. There is always a little mold everywhere - in the air and on many surfaces. There are very few case reports that toxic molds (those containing certain mycotoxins) inside homes can cause unique or rare, health conditions such as pulmonary hemorrhage or memory loss. These case reports are rare, and a causal link between the presence of the toxic mold and these conditions has not been proven. A common-sense approach should be used for any mold contamination existing inside buildings and homes. The common health concerns from molds include hay-fever like allergic symptoms. Certain individuals with chronic respiratory disease (chronic obstructive pulmonary disorder, asthma) may experience difficulty breathing. Individuals with immune suppression may be at increased risk for infection from molds. If you or your family members have these conditions, a qualified medical clinician should be consulted for diagnosis and treatment. For the most part, one should take routine measures to prevent mold growth in the home.

- Q 2. How common is mold, including Stachybotrys chartarum (also known by its synonyn Stachybotrys atra) in buildings?

  A. Molds are very common in buildings and homes and will grow anywhere indoors where there is moisture. The most common indoor molds are Cladosporium, Penicillium, Aspergillus, and Alternaria. We do not have accurate information about how often Stachybotrys chartarum is found in buildings and homes. While it is less common than other mold species it is not rare.

- Q 3. How do molds get in the indoor environment and how do they grow?

  A. Molds naturally grow in the indoor environment. Mold spores may also enter your house through open doorways, windows, heating, ventilation, and air conditioning systems. Spores in the air outside also attach themselves to people and animals, making clothing, shoes, bags, and pets convenient vehicles for carrying mold indoors.
  When mold spores drop on places where there is excessive moisture, such as where leakage may have occurred in roofs,

pipes, walls, plant pots, or where there has been flooding, they will grow. Many building materials provide suitable nutrients that encourage mold to grow. Wet cellulose materials, including paper and paper products, cardboard, ceiling tiles, wood, and wood products, are particularly conducive for the growth of some molds. Other materials such as dust, paints, wallpaper, insulation materials, drywall, carpet, fabric, and upholstery, commonly support mold growth.

- Q 4. What is Stachybotrys chartarum (stachybotrys atra)?

  A. Stachybotrys chartarum (also known by its synonym Stachybotrys atra) is a greenish-black mold. It can grow on material with a high cellulose and low nitrogen content, such as fiberboard, gypsum board, paper, dust, and lint. Growth occurs when there is moisture from water damage, excessive humidity, water leaks, condensation, water infiltration, or flooding. Constant moisture is required for its growth. It is not necessary, however, to determine what type of mold you may have. All molds should be treated the same with respect to potential health risks and removal.

- Q 5. Are there any circumstances where people should vacate a home or other building because of mold?

  A. These decisions have to be made individually. If you believe you are ill because of exposure to mold in a building, you should consult your physician to determine the appropriate action to take.

- Q 6. Who are the people who are most at risk for health problems associated with exposure to mold?

  A. People with allergies may be more sensitive to molds. People with immune suppression or underlying lung disease are more susceptible to fungal infections.

- Q 7. How do you know if you have a mold problem?

  A. Large mold infestations can usually be seen or smelled.

- Q 8. Does Stachybotrys chartarum (Stachybotrys atra) cause acute idiopathic pulmonary hemorrhage among infants?

  A. To date, a possible association between acute idiopathic pulmonary hemorrhage among infants and Stachybotrys chartarum (Stachybotrys atra) has not been proved. Further studies are needed to determine what causes acute idiopathic hemorrhage.

- Q 9. What if my child has acute idiopathic pulmonary hemorrhage?

  A. Parents should ensure that their children get proper medical treatment.

- Q 10. What are the potential health effects of mold in buildings and homes?

  A. Mold exposure does not always present a health problem indoors. However some people are sensitive to molds. These people may experience symptoms such as nasal stuffiness,

eye irritation, or wheezing when exposed to molds. Some people may have more severe reactions to molds. Severe reactions may occur among workers exposed to large amounts of molds in occupational settings, such as farmers working around moldy hay. Severe reactions may include fever and shortness of breath. People with chronic illnesses, such as obstructive lung disease, may develop mold infections in their lungs.

Q 11. How do you get the molds out of buildings, including homes, schools, and places of employment?

A. In most cases mold can be removed by a thorough cleaning with bleach and water. If you have an extensive amount of mold and you do not think you can manage the cleanup on your own, you may want to contact a professional who has experience in cleaning mold in buildings and homes.

Q 12. What should people to do if they determine they have Stachybotrys chartarum (Stachybotrys atra) in their buildings or homes?

A. Mold growing in homes and buildings, whether it is Stachybotrys chartarum (Stachybotrys atra) or other molds, indicates that there is a problem with water or moisture. This is the first problem that needs to be addressed. Mold can be cleaned off surfaces with a weak bleach solution. Mold under carpets typically requires that the carpets be removed. Once mold starts to grow in insulation or wallboard the only way to deal with the problem is by removal and replacement. We do not believe that one needs to take any different precautions with Stachybotrys chartarum (Stachybotrys atra), than with other molds. In areas where flooding has occurred, prompt cleaning of walls and other flood-damaged items with water mixed with chlorine bleach, diluted 10 parts water to 1 part bleach, is necessary to prevent mold growth. Never mix bleach with ammonia. Moldy items should be discarded.

Q 13. How do you keep mold out of buildings and homes?

A. As part of routine building maintenance, buildings should be inspected for evidence of water damage and visible mold. The conditions causing mold (such as water leaks, condensation, infiltration, or flooding) should be corrected to prevent mold from growing.

Specific Recommendations:

- Keep humidity level in house below 50%.
- Use air conditioner or a dehumidifier during humid months.
- Be sure home has adequate ventilation, including exhaust fans in kitchen and bathrooms.
- Use mold inhibitors which can be added to paints.
- Clean bathroom with mold killing products.
- Do not carpet bathrooms.
- Remove and replace flooded carpets.

Q 14. I found mold growing in my home, how do I test the mold?

A 14. Generally, it is not necessary to identify the species of mold growing in a residence, and CDC does not recommend routine sampling for molds. Current evidence indicates that allergies are the type of diseases most often associated with molds. Since the susceptibility of individuals can vary greatly either because of the amount or type of mold, sampling and culturing are not reliable in determining your health risk. If you are susceptible to mold and mold is seen or smelled, there is a potential health risk; therefore, no matter what type of mold is present, you should arrange for its removal. Furthermore, reliable sampling for mold can be expensive, and standards for judging what is and what is not an acceptable or tolerable quantity of mold have not been established.

Q 15. A qualified environmental lab took samples of the mold in my home and gave me the results. Can CDC interpret these results?

A 15. Standards for judging what is an acceptable, tolerable, or normal quantity of mold have not been established. If you do decide to pay for environmental sampling for molds, before the work starts, you should ask the consultants who will do the work to establish criteria for interpreting the test results. They should tell you in advance what they will do or what recommendations they will make based on the sampling results. The results of samples taken in your unique situation cannot be interpreted without physical inspection of the contaminated area or without considering the building's characteristics and the factors that led to the present condition.

Summary: In summary, *Stachybotrys chartarum* (*Stachybotrys atra*) and other molds may cause health symptoms that are nonspecific. At present there is no test that proves an association between *Stachybotrys chartarum (Stachybotrys atra*) and particular health symptoms. Individuals with persistent symptoms should see their physician. However, if *Stachybotrys chartarum (stachybotrys atra)* or other molds are found in a building, prudent practice recommends that they be removed. Use the simplest and most expedient method that properly and safely removes mold.

March 10, 2000 : MMWR Update: Pulmonary Hemorrhage/Hemosiderosis Among Infants --- Cleveland, Ohio, 1993-1996

Report to the CDC Working Group on Pulmonary Hemorrhage/Hemosiderosis - June 17, 1999

Some additional information on fungi and fungal diseases at the CDC Web site:

CDC/NCID Division of Bacterial and Mycotic Diseases: Fungal Diseases

NIOSH publication: HISTOPLASMOSIS: Protecting Workers at Risk

Emerging Infectious Diseases article: "Emerging Disease Issues and Fungal Pathogens Associated with HIV Infection" by Neil M. Ampel, M.D. University of Arizona College of Medicine, Tucson Veterans Affairs Medical Center, Tucson, Arizona, USA

Emerging Infectious Diseases article: "Coccidioidomycosis: A Reemerging Infectious Disease" by Theo N. Kirkland, M.D., and Joshua Fierer, M.D., Departments of Pathology and Medicine, University of California, San Diego School of Medicine and Department of Veterans Affairs Medical Center, San Diego, California, USA

California Department of Health Services
Indoor Air Quality Info Sheet
Mold in My Home: What Do I Do? March 1998

- Air Pollution and Respiratory Health
- Asthma
- Division of Laboratory Sciences
- Emergency and Environmental Health Services
- Environmental Hazards and Health Effects
- Environmental Public Health Tracking
- Global Health Office
- Health Studies
- Mold
- Preventing Lead Poisoning in Young Children
- Vessel Sanitation - Sanitary Inspection of International Cruise Ships

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This page last reviewed June 06, 2002

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